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ABSTRACT

The effectiveness of three basic approaches to sport skills analysis instruction were examined. Ninety-two physical education majors were allocated to four groups and randomly assigned to one of four instructional frameworks: Observational Model (OM), Common Errors (CE), Correct Only (CO), and Control (C). It was hypothesized that the OM group would perform better than the CE, CO, and Control groups on the two analytical tasks of interest: visual retention of overarm throw performance, and knowledge of correct overarm throw technique. It was also anticipated that the CE and CO subjects would perform better on analytical tasks than the control subjects as the result of training. The OM group performance exceeded all other groups on the perceptual task as hypothesized. A majority of the test item response inaccuracies on the part of both the CE and CO subjects were due to a failure to see movement phenomenon that actually occurred in the performances. Following a description of the procedures of the study, these results are analyzed. Copies of the instruments used in the study are appended. (JD)

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A Comparison of Three Methodological Approaches to
Skill Specific Analytical Training

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by

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Introduction

Obvious needs exist for training paradigms which offer effective reduction in the complexities of the observational and diagnostic tasks confronting the teacher and coach. Yet a paucity of empirically-based research exists alluding to the specific nature of such training. Traditionally, where skills analysis instruction is attempted at the undergraduate level, two methodological approaches are utilized, either separately or in combination with each other. Physical education majors are generally exposed to visual and verbal experiences involving the observation and discussion of correct patterns of motor skills, and incorrect patterns of skills which occur with high frequency among beginning level performers. This exposure usually occurs (or is assumed to have occurred) during undergraduates' skills activity-class experiences, or in the kinesiology/biomechanics instructional core. Very few of such analytical training approaches are research-based.

In one controlled study, Hoffman and Armstrong (1975) observed significant short-term learning effects when physical education undergraduates received visual training in observing correct and incorrect performances of the standing long jump. Undergraduates who viewed both correct and incorrect patterns more readily identified performance errors than those who viewed only correct examples of the skill. It was also noted that students trained under correct-only instructional conditions tended to commit analytical errors of overgeneralization. That is, the students exhibited a tendency to mistake instances of incorrect performance for correct performance. Hoffman and Armstrong suggested that such training under correct-only conditions may have induced a "perceptual set" in students to see motor responses as conforming to correct performance criteria when in fact, they did not.

Skills analysis training which has been directed towards the development of organized taxonomies of common performance errors in the past, utilized filmed presentations of skills performed by highly skilled athletes staging the specific errors. Hoffman (1977) questioned the effectiveness of such presentations. It is highly doubtful whether a skilled performer can adequately demonstrate an error as it actually occurs in a novice's performance of the same skill. Staged simulations of errors performed by a skilled athlete tend to isolate the error in the visual display. Performance errors rarely are isolated in real-life situations. In fact, errors often occur simultaneously and in a variety of forms in beginning level learners. Past common error types of analysis approaches, due to procedural and evaluation control problems, have not provided strong data upon which judgement could be made regarding the effectiveness of these training approaches.

Recent research however, has provided empirical support to the supposition that systematic long-term analytical instruction can influence physical educators' abilities to organize the spatial and temporal aspects of movement. Performance of undergraduates (Gangstead and Beveridge, 1984) and physical education teachers (Beveridge and Gangstead, 1984) was enhanced by instruction based on a specific observational framework. In both studies, two components of the analytical process were assessed; (a) short-term retention of observed motor responses, and (b) knowledge of correct motoric patterns. As part of treatment, subjects were instructed in the usage of the observational model during their initial observations of learners' skill attempts. Usage of the model (see appendices) directed the subjects' attention toward the temporal aspects of a performance. Preparation, action, and followthrough phases were identified for each skill under analysis. Special attention was given to; (a) movements of body segments which

initiated or ended each phase, (b) the phases in which the force production was initiated towards the skill objective, and (c) the proportion of the total movement time each phase occupied. The model also suggested a general order in which subjects selectively attended to the primary body segments and their movements across the temporal phases of the skill. This particular spatial dimension of the model directed subjects' attention from the "hub" or slowest moving part of the body, progressively outward, to the motion of the extremities, often the fastest moving body parts. All analytical exercises conducted as part of the treatment in these two studies were based on the utilization of this observational process. Throughout treatment, emphasis was continually placed on; (a) proper description of the skill serving as target for the analysis, (b) how the identified description deviated from the criterion performance previously established, and (c) prescription of prioritized instructional strategies for correction of performance errors. (See appendices for format example).

Although the magnitude of gains in perceptual performance and in knowledge of correct motor patterns as a result of treatment were statistically significant, both undergraduates and teachers averaged between 7% to 13% gains in accuracy on the visual retention tasks assessed. It should be noted that in both the studies, the instructional experiences were rather generic in nature. That is, a variety of skills were presented and discussed under an organization of basic motoric patterns. Skills used in the assessment instruments were not specifically discussed as part of the treatment. Given trends of results in this generic approach, speculation definitely exists as to whether greater gains in perceptual performance would be observed if the observational format was used in instructional experiences designed for the

analysis of sport skills specific to a given sport, and the assessment subsequently required analysis of those same sport skills.

It was the purpose of this study to determine the effectiveness of three basic approaches to sport skill analysis instruction, the common errors (CE), the correct-only (CO) and the observational model (OM), under short-term, skill-specific instructional conditions. It was hypothesized that the OM group of subjects (undergraduate physical education majors) would perform better than the CE, CO, and control groups on the two analytical tasks of interest; visual retention of overarm throw performances, and knowledge of correct overarm throw technique. It was also anticipated that the CE and CO subject would perform better on the analytical tasks than the control subjects as a result of treatment. Gains in perceptual and knowledge performance in experimental subjects were anticipated to be greater than those of subjects studied in earlier research due to the skill specific nature of the present study.

Procedures

Ninety-two Oklahoma State University physical education majors were randomly allocated to four groups which were randomly assigned to one of four treatment conditions (instructional frameworks): Observational Model (OM) n=23, Common Errors (CE) n=23, Correct-Only (CO) n=23, and Control (C) n=23. In order to control for subjects' variability regarding knowledge of correct execution of the overarm throw (OT) and to facilitate communication of the skill, all experimental subjects were provided with specific written skill criteria (figure 1). These criteria were discussed and demonstrated utilizing a videotape depicting ten exact repetitions of the OT performed by a highly skilled thrower. A short written test was administered at the end of the orientation session. A minimum competency level of 80% accuracy regarding the ability

to recall correct skill criteria was required prior to subjects proceeding on to specific treatment experiences.

THROWING: OVERARM PATTERN

Definition: Movement pattern of the arm and hand used to propel an object through space: The object is swung above the shoulder (H, 1981; K, 1982)

MATURE PATTERN

PREPARATION:

- _____ Pivot, rotation of body to side position, legs straddle position.
- _____ Weight shift to back leg.
- _____ Arm brought backwards and upwards, above shoulder, past frontal midline, wrist cocked. (90 degree lateral rotation of humerus)
- _____ Trunk rotation increases as arm is brought back.
- _____ Non-throwing arm up and pointing at target.

ACTION:

- _____ Step forward on opposite foot of throwing arm, weight shift forward.
- _____ Foot plant of support leg in the direction of the throw.
- _____ Arm may retract to final layback position before going forward.
- _____ Rotational sequence of pelvis, lumbar, thoracic, and shoulder areas.
- _____ Shoulder-horizontal flexion; elbow moves forward, extension of forearm, snap of wrist.
- _____ Support leg initially flexed, then will block out during whipping action of the throwing arm.
- _____ Non-throwing arm will cross midline of body, in flexed position, to block for the shoulder area.
- _____ Body remains relatively vertical in alignment during action.
- _____ Object and wrist and hand remain in a plane inside the elbow joint, and above the shoulder.
- _____ Movement throughout the throw is in the direction of the target.
- _____ After sequential action of trunk is complete, may have forward trunk flexion occurring with powerful throws.
- _____ Head should be relatively stable.

FOLLOWTHROUGH:

- _____ Continued direction of the throw (target).
- _____ Gradual dissipation of forces created in body segments in direction of the throw.
- _____ Step taken by same side foot to regain balance.
- _____ Eyes on target, head stationary.

Figure 1. Overarm Throw Criteria

All subjects achieved this competency level or above at the end of the orientation session. The control group received a similar orientation experience, using criteria regarding proper execution of the standing long jump. Ten repetitions of a well executed jump were viewed by the control subjects. Eighty percent accuracy was achieved on the knowledge of the standing long jump by all control subjects.

The OM group subsequently received verbal instruction on the analytical processes associated with the observational model. The same highly skilled thrower's videotaped performance was used to facilitate subjects' categorization of the OT into the temporal and spatial components of the model. Subjects then observed a beginning-level learner executing an OT. Each subject was asked to note deviations of the learner's performance, or absences of correct movements on the part of the learner. Subjects also were instructed to make subsequent performance error judgements based on their observations. All OM-subjects reached at least a 90% level of accuracy on this analytical task.

The CE group received instruction with specific attention given to research-based commonalities of overarm throw performance errors exhibited among beginning-level throwers. The errors discussed and depicted with actual videotaped examples are presented in figure 2. After instruction, the CE subjects observed the same beginning level learner videotape as the OM group. Their instructional task involved indicating (in checklist format) specific errors observed during the observation. All subjects exceeded the 90% accuracy level on the task.

The CO group received additional verbal instruction and further visual demonstrations in application of the correct criteria sheet presented during the orientation session. These subjects then observed and indicated the particular motor characteristics of the beginner's

performance which corresponded to the correct criteria established. All subjects again achieved the minimum competency level established for this analytical task.

COMMON OVERARM THROW ERRORS

- _____ Feet remain fixed
- _____ Unilateral movement (no leg, arm opposition)
- _____ No weight shift forward
- _____ Little or no trunk rotation (body square to target)
- _____ No "Blocking Action" by leg or arm during the throw
- _____ Force comes from hip flexion, shoulder protraction, or elbow extension, rather than summation of levers.
- _____ Side flexion at trunk and shoulder girdle (head turns away)
- _____ Elbow too close to body, results in "pushing" action
- _____ Ball is held in palm of hand instead of fingers
- _____ Little or no wrist flexion, thus no "snap" on release
- _____ Followthrough is interfered with (negative weight transfer or arm stoppage)
- _____ Followthrough deviates from direction of target

Figure 2. Errors Checklist

The control group received verbal and visual demonstrations of two videotaped illustrations of beginning level learners' skill attempts at the standing long jump. Both correct and incorrect characteristics of the jumping pattern were pointed out. Upon observation of a third videotaped performance, subjects were asked to indicate three major errors in the performance. All subjects were able to identify at least two of the three errors illustrated correctly.

The total treatment duration for each group was approximately four

hours. Instructional sessions were completed at one hour intervals, on four different days, including the orientation session, during a two week period.

Instrumentation

The overarm throw subtest of the Utah Skills Analysis Test (USKAT) (Beveridge and Gangstead, 1983) was utilized to assess performance on both dependent variables of interest. Short-term visual retention of overarm throw performance was assessed using the perceptual portion of the USKAT subtest which consisted of a series of five videotaped illustrations of actual learner performances of the OT. Subjects viewed five trials of each performance, exactly reproduced in the following sequence; (a) two sideviews, (b) two front views, and (c) another sideview. Front and sideviews were the same performance of the learner. Subjects viewed a performance sequence, and then were allowed to read and respond to written movement descriptions relevant to the particular performance. The response format (See Appendices) required subjects to indicate the presence or absence of specific movement phenomena in each performance viewed. Knowledge of the correct overarm throw pattern was assessed utilizing the same movement descriptions as items categorized under the subtest in the knowledge component of the USKAT.

Collection of Data

The OT subtests of the USKAT were administered to all subjects prior to the orientation session and initiation of treatment conditions. The testing area consisted of a small classroom furnished with two 19-inch color video monitors connected to one master VHS recorder. Four to five subjects were seated in front of each monitor at a distance of between four to six feet. The total duration time of the perceptual task was approximately 15 minutes. Subjects were allowed a three minute

rest period prior to administration of the knowledge component of the test. A total of 15 responses were elicited from each subject on each component of the subtest. Scores were computed as total number of correct responses per test. Subjects were administered the same perceptual and knowledge tests in the same manner at the conclusion of their respective instructional experiences.

Results

A pretreatment-posttreatment with control group design was utilized to determine the effects of instructional approach on visual retention and knowledge of the overarm throw. Summative descriptive data for the groups regarding each assessment are shown in Table 1. In order to ascertain the initial equivalency of the experimental and control groups, one-way ANOVA's for each dependent variable were conducted on the pre-treatment data.

MEAN PERFORMANCE SCORES AND STANDARD DEVIATIONS
FOR THE OVERARM THROW ANALYTICAL TESTS

		GROUP (92) ^A							
		<u>MODEL</u> (23) ^B		<u>COMMON</u> <u>ERRORS</u> (23)		<u>CORRECT-</u> <u>ONLY</u> (23)		<u>CONTROL</u> (23)	
		PRE	POST	PRE	POST	PRE	POST	PRE	POST
PERCEPTUAL COMPONENT (15) ^C	X	8.43	10.57	8.78	9.48	8.57	9.09	8.48	8.47
	SD	1.47	1.65	1.20	1.31	1.47	1.28	1.90	1.62
KNOWLEDGE COMPONENT (15)	X	9.91	11.91	9.48	11.83	9.57	10.09	9.61	9.47
	SD	2.15	1.41	1.41	2.04	1.53	1.56	1.53	1.27

A = TOTAL N

B = NUMBER IN EACH GROUP

C = MAXIMUM SCORE POSSIBLE

Table 1

A $F(3,88) = .234$ ($p > .05$) and $F(3,88) = .291$ ($p > .05$) for the visual retention task and knowledge task respectively, were noted. Analysis of the critical tests indicated no statistically significant differences between the groups on either dependent variable. It was concluded that random selection and assignment of the subjects to groups achieved equality of performance as measured by the USKAT OT subtest prior to treatment.

The ANOVA conducted on the visual retention data revealed a significant group effect, $F(3,88) = 8.167$ ($p < .001$). Newman-Keuls post hoc analysis revealed that the observational model group performed significantly better on the perceptual task than any of the other three groups. Observed differences between the CE group, the CO group and the Control group failed to reach statistical significance. However the CE and CO groups did perform better than the control group on the task. The CE group exhibited slightly higher levels of accuracy on the task than the CO group.

The ANOVA conducted on the knowledge data indicated significant group effects, $F(3,88) = 13.65$ ($p < .001$). Post hoc analysis indicated both the OM and CE groups performed significantly better than the CO and Control groups. The CO group performed only slightly better than the C group. No significant difference was revealed between the OM and CE groups on the knowledge task.

Discussion

The OM group performance exceeded all other groups on the perceptual task as hypothesized. Further inspection of the data revealed that a majority of the test item response inaccuracies on the part of both the CE and CO subjects were due to observational "misses", a failure to see movement phenomenon that actually occurred in the

performances. It would appear logically, that perceptual set biases were indeed induced as a result of respective treatments. Analysis of the data indicated that improved posttreatment perceptual scores on the part of the OM subjects was due largely to fewer misses of movement phenomenon during observation of the overarm throw. It seems logical that the instructional observational experiences with the framework utilized in the OM group would broaden the cognitive schema of "overarm throw" performance among the subjects. Perhaps concentration of correct criteria of performance and deviations (in only performer-specific sense) of performance from criteria enhances the reduction of selective biases or attentional sets among observers. Although not statistically significant, the CE group, which did receive both correct and incorrect instructional experiences did perform better than the CO group. This trend concurs with similar observations in the Hoffman & Armstrong (1975) study.

Most importantly, it should be noted that all groups, except the control group did improve on the visual retention task as a result of treatment. Such findings should support the continued emphasis on skill analysis training as part of physical education majors preservice training. Pre-posttreatment gains of 15% are encouraging from an educational standpoint, particularly when consideration is given to the extremely short nature of the training experiences in this study. It is apparent that utilization of the model under skill specific conditions enhances observational performance to a greater extent than a generic patterning approach. However, the practicality of such an analytical approach to undergraduate training is open to question. It does suggest possible applications of model usage and analysis of skills students may be exposed to in skills sequences. The issue of perceptual "transfer" of the observational schemas involved has yet to

be investigated in a controlled manner. Evidently transfer does not occur when observing a jumping pattern compared to throwing pattern observation. The observational experiences of the control group did not effect those subjects' ability to retain OT performances. Perhaps the model approach will lend itself to transfer problems. More research in this area is certainly warranted.

Knowledge scores did not improve at magnitudes expected across experimental groups. It is the author's speculation that the format of the knowledge subtest may account for the relatively low scores exhibited by the subjects. The wording and format of the test is different than much of the wording on the correct skills criteria sheet used in the treatments. Subjects performed much better on their separate analytical tasks within their groups than on the subtest. Therefore, subject variability on the subtest may be a function of instrumentation format variation from those used during the treatment. Improvement still occurred, and is encouraging to those who may teach correct skills criteria in kinesiology/biomechanics classes at the college level.

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Appendices

BODY COMPONENTS	PREPARATION	ACTION	FOLLOW THROUGH
PATH OF HUB			
BODY WEIGHT			
TRUNK ACTION			
HEAD ACTION			
ACTION OF LEGS			
ACTION OF ARMS			
IMPACT/RELEASE			

OBSERVATIONAL MODEL

OBSERVATIONAL MODEL
GROUP - ANALYTICAL ASSIGNMENT

PREPARATION PHASE

MOTION COMPONENTS	CORRECT MOTION OF THE OT	SUBJECT'S MOTION	NEEDED CORRECTIONS
Path of Hub			
Body Weight			
Trunk Action			
Head Action			
Action of Legs			
Action of Arms			

Questions:

1. Which component in the preparation phase contributes most to the proper execution of the skill you have just analyzed?

Justify.

2. Which component contributes least?

Justify.

ACTION PHASE

MOTION COMPONENTS	CORRECT MOTION OF THE OT	SUBJECT'S MOTION	NEEDED CORRECTIONS
Path of Hub			
Body Weight			
Trunk Action			
Head Action			
Action of Legs			
Action of Arms			
Impact/Release			

Questions:

1. Which component contributes most to the proper execution of the skill you have just analyzed in the action phase?

Justify.

2. Which component contributes least?

Justify.

FOLLOW THROUGH PHASE

MOTION COMPONENTS	CORRECT MOTION OF THE OT	SUBJECT'S MOTION	NEEDED CORRECTIONS
Path of Hub			
Body Weight			
Trunk Action			
Head Action			
Action of Legs			
Action of Arms			

Questions:

1. Which component in the follow through phase contributes most to the proper execution of the skill you have just analyzed?
Justify.
2. Which component contributes least?
Justify.

SKILLS ANALYSIS TEST

PART ONE

This test is designed to assess your ability to remember various aspects of performances of adolescents executing the overarm throw. In this test you are asked to view a total of five different performances. After you have viewed a performance, you will be asked to indicate whether or not you observed the movements described in the test items during that particular performance. ***You will not be permitted to read the test items prior to viewing the performance displayed on the video monitors.***

The sequence of visual displays you are about to see will be followed for each performance viewed during the test.

- a. A sideview of the performance, exactly repeated two times.
- b. A frontview of the exact same performance, repeated two times.
- c. And a repeat of the sideview shown once more.

***After you have viewed a performance sequence, the investigator will direct you to turn the page and respond to the appropriate items. When you are finished with your responses, place your pencils down, and wait for the next performance to appear on the screen.

DO NOT TURN THE PAGE UNTIL YOU ARE INSTRUCTED TO DO SO!!!

SUBJECT A: OVERARM THROW

Movement Observed?

YES=A NO=E

1. During the forward motion of the throw, the non-throwing arm's shoulder dips noticeably to the side.
2. The hips remain relatively square (facing) to the target during the backswing (preparation) of the throwing arm.
3. Immediately after the release of the ball, the non-throwing arm is allowed to travel to the side of the body, to a point backward of the hips.

PENCILS DOWN, DO NOT TURN THE PAGE UNTIL INSTRUCTED, GET READY
TO VIEW THE NEXT PERFORMANCE.

SUBJECT E: OVERARM THROW

MOVEMENT OBSERVED?

YES-A

NO-E

4. During the throw, the eyes remain focused on the target, with the head held in a stable position.
5. The forward leg is straightened as the forceful forward action of the throwing arm is initiated.
6. The non-throwing arm is bent, with the forearm nearly crossing the vertical midline of the body as the forceful throwing action of the arm occurs.

DO NOT TURN THE PAGE UNTIL INSTRUCTED TO DO SO.

SUBJECT 1: OVERARM THROW

MOVEMENT OBSERVED?

YES-A

NO-E

7. Sequential rotation of the hips, trunk, and shoulders towards the target occurs prior to the release of the ball.
8. The throwing arm's elbow leads the same side shoulder during the forward motion of the throw.
9. After the release of the ball, the throwing arm follows through in the direction of the throw.

DO NOT TURN THE PAGE UNTIL YOUR INSTRUCTED TO DO SO.

SUBJECT M: OVERARM THROW

MOVEMENT OBSERVED?

YES=A

NO=E

10. The knee of the forward stepping leg is noticeably bent as it supports the body's weight during the initial part of the throw.
11. The foot of the forward stepping leg is planted with the toes pointing in the direction of the throw.
12. After the release of the ball, a step is taken forward by the leg on the same side as the throwing arm.

DO NOT TURN THE PAGE UNTIL INSTRUCTED TO DO SO.

SUBJECT A: OVERARM THROW (TAPE TWO)

MOVEMENT OBSERVED?

YES=A

NO=E

13. The leg opposite the throwing arm steps towards the target, supporting the body weight throughout the throw.
14. The elbow of the throwing arm drops towards the trunk during the forward action of the throw.
15. After release of the ball, the hips remain square(facing) to the target.

THIS CONCLUDES PART ONE OF THE SKILLS ANALYSIS TEST. PLEASE BE SURE THAT YOU HAVE DARKENED IN YOUR RESPONSES SO THEY ARE EASILY DISCERNABLE. WAIT QUIETLY FOR DIRECTION TO PART TWO OF THE TEST.

SKILL ANALYSIS TEST

PART TWO

This portion of the test is designed to assess your knowledge about correct performance of the overarm throw. Read each movement description. Indicate "YES" = A, if you feel the movement described would occur in a correct performance of the skill. Indicate "NO" = E, if you feel the movement described would not occur in an correct performance of the skill.

(Same Items as in PART ONE)